Article

Private Pension Systems Built on Precarious Foundations: A Cohort Study of Labor-Force Trajectories in Chile

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Abstract

The success of private pension systems to provide old-age security is mainly a function of continuous individual pension contributions linked to formal employment. Using a rich longitudinal dataset from Chile and employing sequence analysis, this study examines the pension contribution histories and formal employment pathways of a cohort of individuals who began their working lives simultaneously to the introduction of the Chilean private

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pension system in the early 1980s, which pioneered private-oriented pension reforms worldwide. Results show that more than half of the individuals from this cohort developed labor-force trajectories inconsistent with continuous pension contributions and formal employment, which particularly affects women and lower educated people. We conclude that policy and decision makers focused on aging topics should be aware of the increasing diversity and precariousness of labor-force trajectories when evaluating the performance and sustainability of both private and public pension regimes.

Keywords

pension system, employment, old age, inequalities, life course

Financing the retirement of an aging population is one of the major global challenges that policy and decision makers face today. Much of this debate has focused on developed countries where the situation has become acute. Developing countries with more minimal welfare state provisions, however, are equally pressed for solutions. In this context, structural social security reforms implementing pension systems based on individual retirement accounts (IRAs) became popular in the 1980s and 1990s to contain the fiscal pressures associated with an aging population and lower birth rates (World Bank, 1994).

IRAs often replaced—at least partially—traditional pay-as-you-go (PAYG) pension systems. Governments with a market-oriented approach adopted IRAs in the belief that population aging would unavoidably lead to the collapse of publicly funded PAYG and noncontributory systems. In PAYG defined-benefit regimes, workers finance the pension benefits of retirees with their current contributions. But as populations age, the ratio of contributing workers to an increasing number of pensioners (who are also living much longer) decreases significantly, thus increasing the fiscal contributions that governments must make to sustain pensions. Both developed and developing countries introduced privately run IRAs within their existing public pension systems (see Bertranou, van Ginneken, & Solorio, 2004; Gran, 2008; Madero-Cabib, 2017).

Chile is known worldwide as a paradigmatic case of a private pension system (Arenas-De Mesa & Bertranou, 1997; Arza & Kohli, 2008; Ginn, Street, & Arber, 2001; Higo & Williamson, 2011; Mesa-Lago, 1997, 2002; Quadagno, Kail, & Shekha, 2011). In 1981, this country became the first in replacing completely its PAYG pension system by a mandatory IRA scheme.

Over the last decades, research has focused on the evaluation of the implementation and evolution of this pioneer pension system, often concentrating on its macroeconomic dimensions. These include positive outcomes such as the expansion of domestic capital markets, growth, fair capital returns, and a swift transition with no apparent effects on interest rates, but also negative outcome such as limited competition among private fund administrators and high administrative costs (Arenas-De Mesa & Mesa-Lago, 2006; Barr & Diamond, 2009).

Today, after 35 years of maturation, Chile's pension system has produced a first cohort of pensioners covered almost exclusively by the IRA scheme. Therefore, we are at a right time to improve on past research by critically evaluating IRA's generally neglected microeconomic dimensions. Specifically, we focus on two dimensions of individuals' careers that underlie the structural design of IRA-based pension systems: *continuity of pension contribution histories* (Orszag & Stiglitz, 2001) and *formality of employment* (Corsetti & Schmidt-Hebbel, 1995). In addition, we test for the social inequalities that, according to more critical literature, this new system might have preserved or created in these two dimensions (Ginn et al., 2001; Quadagno et al., 2011).

To evaluate pension contribution histories, employment formality, and inequalities in contributions and formality, we analyze the labor-force trajectories of the cohort of workers who were incorporated into the IRA pension scheme from its outset in the early 1980s and have been participating in the labor force for 30 years as the IRA scheme evolved. Our specific research question is whether the introduction of IRAs led to and shaped individual labor-force trajectories consistent with the assumptions of this private system on these microeconomic dimensions.

Methodologically, we study these working paths using a rich Chilean longitudinal dataset and employing sequence analysis (Abbot & Tsay, 2000). This longitudinal statistical technique allows us to analyze similarities and differences between individual labor-force trajectories and then to cluster similar trajectories in specific types.

This article is organized as follows: First, we briefly summarize our case study, relevant literature, hypotheses, and our contribution to this literature. Second, we discuss the dataset, cohort sample, variables, and methods. Third, we introduce our empirical analysis of labor-force trajectories derived from different pathways of pension contribution histories and employment formality. Results show that the labor-force trajectories of approximately half of the Chilean labor force does not fit the theoretical assumption of continuous pension contributions and formal employment. Fourth, we conclude by

discussing these results and their methodological and policy implications. In particular, we point to the fact that policy makers focused on aging should be aware of the increasing diversity and precariousness of labor-force trajectories when evaluating the performance and sustainability of both public and private pension regimes.

The Chilean Case, Theoretical Background, Hypotheses, and Novelty of the Approach

The Chilean Pension Reform

In 1981, under a military dictatorship, Chile became the first country to replace its PAYG pension system by a mandatory defined-contribution IRA scheme with no component of shared funding. Workers began contributing 10% of their wages to their own IRA, while contributions from employers and the state were eliminated. The mandated savings are deposited in individual pension accounts, which are administered by private pension fund administrators (*Administradoras de Fondos de Pensiones* or AFPs). AFPs are for-profit companies that invest workers' savings and charge an upfront administration fee of around 2.6% of the worker's wage (this includes a disability and survival insurance premium). Together with this private pillar, the state provided two types of noncontributory subsidies for those with few or no contributions: a *Noncontributory Pension* for elderlies living in extreme poverty, which amounted to a third of the minimum wage, and a *Minimum Guaranteed Pension Subsidy* aimed at complementing pensions of individuals with at least 20 years of contribution history.

However, discouraged by the economic and political costs of these policies, most developing countries from Latin America and Eastern Europe that undertook structural and parametric reforms in the contributory pillar during the 1980s and the 1990s introduced or expanded noncontributory pension schemes during the 2000s in order to prevent poverty in old age (Bertranou et al., 2004; Melguizo, Bosch, & Pages, 2015; Ortiz, Durán-Valverde, Urban, & Wodsak, 2018). Chile was not an exception, and under a democratic government, a substantial reform was made in 2008, which improved the noncontributory component of the pension system but maintained with slight modifications, the IRA regime. The *Noncontributory Pension Benefit* was transformed into a *Solidarity Basic Pension* (*Pension Básica Solidaria*) increasing its coverage from 20% to 60% of the most vulnerable population in old age. Also, the *Guaranteed Pension Subsidy* was converted into the *Supplementary Pension* (*Aporte Previsional Solidario*) aimed at enlarging

pension benefits of workers with 20 years or more of contributions, who have accumulated low levels of savings in their individual accounts. In addition, the 2008 reform also established a supplementary amount that is paid into the individual savings accounts of women for each child, born or adopted, equivalent to 10% of 18 times the minimum wage (approximately US$820).

When the private pension system was introduced in the early 1980s, Chilean policy makers pursued the long-term financial sustainability of the new pension regime while improving market conditions for economic growth. These objectives, however, were based on strong assumptions about the actual microeconomic behavior of individuals with respect to pension contributions and employment formality. We discuss these assumptions below.

Continuity of Pension Contribution

Under IRA systems, pension income upon retirement is primarily a function of individual savings during one's working life. Accordingly, promoters of IRAs often assumed that these rules encourage people to contribute constantly to their pension funds (World Bank, 1994). Unlike PAYG schemes, IRA systems visibly connect savings with pensions and thus promote awareness that individual contributions are crucial for financial well-being during retirement (Corsetti & Schmidt-Hebbel, 1995). Hence, individuals should make career choices that will allow them to contribute continuously and systematically to their pension funds (Mesa-Lago, 1997; Reisen, 1997). Accordingly, the first cohort of workers who were mandated to contribute to this system should have developed labor-force trajectories consistent with high pension contributions (Hypothesis 1).

Formal Employment

By promoting an actuarial relationship between individual contributions and pension benefits, advocates of IRAs thought that workers would seek an employment status consistent with their need to make systematic contributions. Workers would either seek formal employment or formalize existing informal activities or employment relationships in order to improve their future pension levels (Callund, 1999; Corsetti & Schmidt-Hebbel, 1995). In the particular case of Chile, by reducing pension contribution rates to 10% of salaries, and accumulating them in individual saving accounts, policy makers expected to end labor market distortions

such as free riding on pension contributions by working in the informal sector. Moreover, studies show that under PAYG systems, contributions are often interpreted by workers as a tax, whereas under an IRA scheme, workers would consider contributions as their own (Quadagno et al., 2011). Thus, the first cohort of workers under the new IRA regime should have transitioned to formal employment in the long run, that is, full-time wage-earner jobs with open-ended contracts to ensure their future pensions (Hypothesis 2).

Social Inequalities

Critics of contributory schemes, both PAYG and IRA, question a progressive transition to labor-force trajectories consistent with high pension contributions and formal employment, suggesting that only the more educated workers with high levels of income and job protection would follow such trajectories (Sehnbruch, 2006, 2013; United Nations Development Programme (UNDP), 2017). Gender inequalities are also significant with regard to employment and pension contributions, although recent policy reforms such as the strengthening of the noncontributory pillar in 2008 have lessened gender gaps (Amarante, Colacce, & Manzi, 2017). Although the share of women in paid employment has risen in the last two decades, Chile exhibits one of the lowest rates of female labor participation among Organisation for Economic Co-operation and Development (OECD) countries: 52% compared to 72% for males and 59% for women in the rest of the OECD (Madero-Cabib, Undurraga, & Valenzuela, 2019). As recent cross-sectional research shows, unequal participation in the labor market leads to gender inequalities in contribution densities (i.e., months of contribution relative to months of work): on average, 33% for women and 49% for men as well as inequalities in pension replacement rates especially among lower income earners: 36% for women and 40% for men (Comisión Asesora Presidencial sobre el Sistema de Pensiones [CAPSP], 2015; OECD, 2017a).

In summary, some scholars argue that women and less educated workers are more vulnerable to experiencing long-term unemployment, precarious jobs, high levels of job turnover, and career interruptions leading to lower contributions and low pension income upon retirement (Ginn et al., 2001; Prus, 2007; Quadagno et al., 2011). Following this critical literature, the implementation of IRAs should not improve equality in pension contributions and formal employment within the cohort of workers under study (Hypothesis 3).

Novelty of the Approach Used in this Study

Research on pension systems in Chile and other developing countries often relies on cross-sectional data and compares averages of younger and older workers rather than looking at specific cohorts of workers over time (see Comisión Económica para América Latina y el Caribe (CEPAL), 2017 for further discussion). Thus, it mostly presents aggregate trends that are difficult to interpret. Specifically in Chile, we are unable to understand whether existing cross-sectional figures on pension contributions, employment formality and social inequality in contributions and formality, are the result of cohort or of life cycle processes that have occurred since the introduction of the IRA system. On the other hand, research that has used longitudinal data has focused exclusively on implications for pension benefits and entitlements. We know a great deal about the pension returns of IRA and, particularly, about replacement rates. These data are used to both document existing replacement rates and project future ones, particularly as cohorts change and the rules of the system are reformed, as in 2008. Berstein, Larraín, and Pino (2006) and Forteza et al. (2009), for instance, use longitudinal administrative data to project pension benefits, while Felix (2012) shows how health and economic literacy shape the decision to retire later under Chile's IRA schemes, and Fajnzylber and Robalino (2010) reconstruct labor histories to project retrospectively the fiscal impact of the Chilean pension reform. The official documentation of the 2008 reform also includes simulations by the OECD for people retiring in the 2020s (CAPSP, 2015). According to these figures, the median replacement rates in the 2020s for individuals with almost complete contributions would be around 31% and 42% for women and men, respectively. The figures are below 5% for individuals with a minimum amount of contributions (CAPSP, 2015, pp. 89–90). Hence, the literature has already documented the current and potential financial performance of the pension system.

The strength of these projections lies, partly, in the rigidity of the Chilean IRA system. Employers withhold workers' contributions and pay them directly into workers' IRAs. Contributions are, then, always 10% of their monthly wage. Individuals who want to save more open voluntary IRAs. From 2019, the tax authority will withhold the contributions of the self-employed and deduct them from their assessed monthly income. Hence, the amount of contributions is not sensitive to the individual perception of financial markets as it is always a fixed percentage of the monthly income. Similarly, while studying how IRAs accumulate wealth might prove useful, the first task is to understand whether employment and contribution

trajectories allow individuals to save for retirement. Although it is important to evaluate the generosity of pension benefits, we know less about life-course trajectories and the decisions that feed IRAs. Accordingly, we first reconstruct the labor-force trajectories of individuals who began working at the outset of the privatization of the pension regime and then critically analyze the processes underlying aggregate trends of pension contribution, employment formalization, and unequal access to IRAs. This is the first cohort that worked mostly under this new regime, that is, from the 1980s onward. In this way, we differ from policy evaluations of the pension regime by examining the intracohort dynamics underlying the introduction of this new system and assessing the persistence and change of work statuses, combining information on employment formality and pension contribution throughout the life course of a specific cohort (Komp-Leukkunen, 2019). In turn, following the same individuals of one cohort over time will allow us to identify whether their life choices were consistent with the policy assumptions of IRA pension regimes.

Data, Cohort Sample, Variables, and Method

Data

We use data from the Chilean Panel Survey on Social Protection (*Encuesta de Protección Social* or EPS), which is representative of the whole population aged 18 or more. First conducted in 2002, it now registers five valid waves (2002, 2004, 2006, 2009, and 2015) and constitutes Chile's oldest and largest longitudinal survey. Crucially, we improve on research that relies on longitudinal administrative data. Administrative data provide information on contribution histories for individuals in formal employment and the self-employed who contribute to their IRAs. Therefore, it does not consider individuals in informal employment and their less frequent contribution histories. Through the EPS, we can zoom into those individuals who are not registered in administrative records.

Each one of the EPS waves includes a module on retrospective employment histories. These modules provide information on labor market participation, employment status, and periods of unemployment and inactivity, from age 15 onward. Specifically, individuals were asked about their work histories from 1980 (the onset of the private pension pension) until the date of the last survey wave that each person participated. During the face-to-face interview, the interviewer registered the starting date (year and month) of each period of employment, unemployment, or inactivity, and, if applicable,

the ending date (year and month) of each period. Hence, labor-force participation is measured in months. Data collection involved the use of life history calendars that helped respondents to remember and chronologically organize the various episodes during their working lives, along with approximate dates of occurrence (Morselli, Berchtold, Granell, & Berchtold, 2016; Morselli et al., 2013).

Since its introduction, the life history calendar has been shown to be a very useful longitudinal survey tool for collecting retrospective information on long-term life pathways (Freedman et al., 1988). Notably, some of the main advantages of collecting longitudinal data through a retrospective methodology (instead of a panel methodology, in which individuals are followed over multiple points in time) are its lower costs in terms of time and economic resources and the possibility of examining longer life periods.

The literature has shown that the retrospective recall of events is not a linear process but a cognitive action involving three different mechanisms: first, the hierarchical order of life events (i.e., those more and less relevant for each person); second, the sequential order of events (i.e., which event happened first and which event happened afterward); and third, the parallel order of events (i.e., the interrelations between the occurrence of events in one domain and the occurrence of events in other domains; Conway, 1996). Life history calendars address these three mechanisms of the operation of autobiographical memory.

However, one critique of life history calendars is that respondents are likely to omit or misreport information due to memory bias, as they may not accurately remember events confronted during the early stages of their lives (Dasoki, Morselli, & Spini, 2016). It has also been demonstrated that the misreporting of information about past events is not random within the population, but, rather, is more prevalent within specific genders and social classes (Couppié & Demazière, 1995). As Morselli, Berchtold, Granell, and Berchtold (2016) summarize, to mitigate memory errors and improve the accuracy of autobiographical memories when using these questionnaires, scholars use innovations such as decomposing life events into event subcategories in different life domains; using highly illustrative visual aids to distinguish such life domains; using reversed chronological order to document life events (i.e., starting with the current life situation and going back in time); and allowing respondents to answer the questionnaire over longer periods of time, making it possible for them to correct information and, thereby, increase the accuracy of the reports (Glasner, van der Vaart, & Dijkstra, 2015). By implementing these and other innovations, scholars have shown that life history calendars: (i) provide more consistent reports on early

life experiences than conventional retrospective questionnaires; (ii) are successful tools for enhancing memory about specific life transitions, such as educational, familial, or labor force shifts; (iii) have better completeness than conventional question-list questionnaires thanks to visual aids; and (iv) increase the accuracy of memories about long-term life paths thanks to the integration of a calendar (Morselli et al., 2016).

In this research, we arranged the monthly information of work histories collected through life history calendars in a dataset that systematized participation in the labor market for each individual between 1980 and 2015, a total of 35 years. As only a proportion of the sample reported information throughout the complete 35 years, we restricted our sample to labor-force participation during 30 years to increase its size. Consequently, if an employment history commenced in 1980, the observation period ends in year 2010, while in the case of another history, which started in 1985, the observation period concludes in year 2015 so as to provide 30 years of analysis in both cases. In other words, the beginning of a labor-force trajectory might be between 1980 and 1985, while the end might be between 2010 and 2015.

Cohort Sample

We focused specifically on those individuals who were aged 30 at the beginning of the observation period (early 1980s) and analyzed them during the 30-year period between age 30 and 60, a key stage of working life. In the EPS, 3,782 respondents met both selection criteria (i.e., to be aged 30 in the early 1980s and have 30 years of observed employment history) and therefore constitute our sample for this study. Given the 361 months of observations per individual (between the first month of age 30 and the first month of age 60), these 3,782 subjects correspond to 1,365,302 monthly observations (3,782 individuals × 361 months). To make the most of the available information, we tolerated individuals in the sample with a maximum of 15% of missing values across the 361-month period (only 2.4% of the sample had this proportion of missing values). To be certain that our results were not affected by potential sample selection bias or the loss of population representativeness caused by attrition and differential nonresponses across survey rounds (which could, in turn, lead to erroneous or nonrepresentative results), we ran our main models weighted by an expansion factor equal to the inverse probability of being selected in the original survey wave, adjusted by the probability of nonresponse in the last wave answered by each person. The propensity score method was used to calculate the nonresponse adjustment. This technique measures, for each individual,

both the probability of being contacted to answer the survey and the probability of answering the survey, depending on such individual characteristics as gender, age, and region of residence (Rosenbaum & Rubin, 1983). As seen in Appendix A, unweighted and weighted results remain highly stable.

Variables

To analyze the monthly labor-force trajectories of workers between the ages of 30 and 60, we focused on four crucial statuses to assess the employment formality and pension contribution histories:

   i. Employment condition: Whether individuals worked or not (including inactivity, unemployment, and periods of job search).
   ii. Time-based employment: Whether they worked full-time (more than 30 hr per week) or part-time (30 hr or less per week).
   iii. Employment status: Whether they worked as wage earners or were self-employed.
   iv. Contribution status: Whether they contributed or not to their individual pension account.

   Whereas the first three employment statuses provide information on formal employment, the fourth employment status provides information on contribution histories. Based on the previous section, we define a formal worker as a wage earner in a full-time, open-ended job with a written contract. Because we are evaluating IRA's system for the whole working-age population, it makes sense to include those who worked sporadically and followed a more heterogeneous career. This allows us to map transitions between part-time and full-time work, formal–informal employment, and employment inactivity. In this way, we are including individuals who are usually excluded from administrative data as they work outside the formal labor market. For the empirical analyses, these four statuses are combined to constitute nine mutually exclusive work statuses, which provide joint information on the employment formality and pension contribution condition of each individual at a given month:

   i. Full-time wage earner contributing to pension (*FT wage-earner contributions*).
   ii. Full-time wage earner not contributing to pension (*FT wage earner no contributions*).
   iii. Full-time self-employed contributing to pension (*FT self-employed contributions*).

iv.   Full-time self-employed not contributing to pension (*FT self-employed no contributions*).

v.   Part-time wage earner contributing to pension (*PT wage-earner contributions*).

vi.   Part-time wage earner not contributing to pension (*PT wage earner no contributions*).

vii. Part-time self-employed contributing to pension (*PT self-employed contributions*).

viii. Part-time self-employed not contributing to pension (*PT self-employed no contributions*).

ix.   Not in the labor force.

The analysis of these work statuses through the labor-force trajectory of individuals provides information with which we can test Hypotheses 1 and 2. In order to analyze Hypothesis 3, namely social inequalities in pension contribution and employment formality, we characterize labor-force trajectories by the following demographic indicators: gender (female, male), year of birth, education (none or primary, secondary, and tertiary), number of children (zero, one, two, three, or more), and marital status (married or partnered, divorced or separated, widow, and single). We also break these trajectories by pension income decile and household income decile (which includes labor income and pension income of all household members). It is important to note that for the analysis of labor-force trajectories, we could have considered additional work statuses, for example, contract type, industry sector, or income level. However, combining them with the selected statuses would create too many possibilities of work situations, which in turn would lead to diffuse labor-force trajectories.

Method

We employ sequence analysis to reconstruct labor-force histories of individual workers. Sequence analysis corresponds to an innovative and relatively new technique in the social sciences that aim to examine latent individual life trajectories unfolding in diverse domains across the life course (Abbott & Tsay, 2000). Although in social sciences it has been used mainly in life course studies (see, e.g., Fasang, 2014; Madero-Cabib & Fasang, 2016), we believe that this methodology can make an important contribution to the study of public policy on aging, especially because it allows us to concentrate on the process that underlies inequalities and disadvantages in old age. Also, it complements research focused on pension benefits and entitlements, by

focusing on the main work statuses and transitions unfolding during the working life of an individual previous to the retirement transition. These statuses and transitions will help us understand whether individuals developed a career consistent with the assumptions of pension policy and to determine the factors that might affect their old-age financial well-being. It is worth mentioning that sequence analysis is a technique rooted in group-based trajectory modeling, which is one of the existing statistical approaches to analyze individual trajectories. Other approaches include latent class analyses, latent class growth analyses, and growth mixture modeling. As has been indicated in recent literature (see, e.g., Mikolai & Lyons-Amos, 2017; Piccarreta & Studer, 2019; Warren, Luo, Halpern-Manners, Raymo, & Palloni, 2015), it is important to acknowledge that all inferences, results, and conclusions made while using any of these approaches are affected by the procedures and preconditions of each method.

Concretely, sequence analysis has three purposes that fit the research objectives and the retrospective data used in this study. First, it allows us to organize the individual trajectories of work statuses experienced chronologically (monthly) by each individual between ages 30 and 60. Second, it helps us identify the similarities and differences between individual trajectories. To this end, we considered the type of status, the timing, and the order in which individuals experienced these different statuses. For instance, two individual sequences might be considered similar if both experience full-time employment from age 30 to 50 and then both switch to part-time employment and remain in this status until the end of the observation period (age 60). Here, we observe similar types of work statuses (full-time and part-time jobs), similar timing at which work statuses are experienced (full-time job from age 30 to 50 and part-time job afterward), and a similar order of work statuses (first a full-time and then a part-time job).

The comparison of similarities/differences between every pair of individual trajectories results in a *distance matrix* that summarizes the modifications needed for converting one sequence into another. While there are different methods to calculate these distances, which weight the timing and the order of statuses differently (such as dynamic Hamming distances and generalized Hamming methods), in this study, we employed optimal matching analysis (OMA). OMA articulates distances between individual trajectories "in terms of the minimal amount of energy that is required to change two sequences such that they become identical" (Elzinga, 2007, p. 3).

Third, a hierarchical cluster analysis can be run over the distance matrix. This allows us to group similar trajectories in different types, that is, trajectories composed by similar statuses, by statuses experienced in similar time
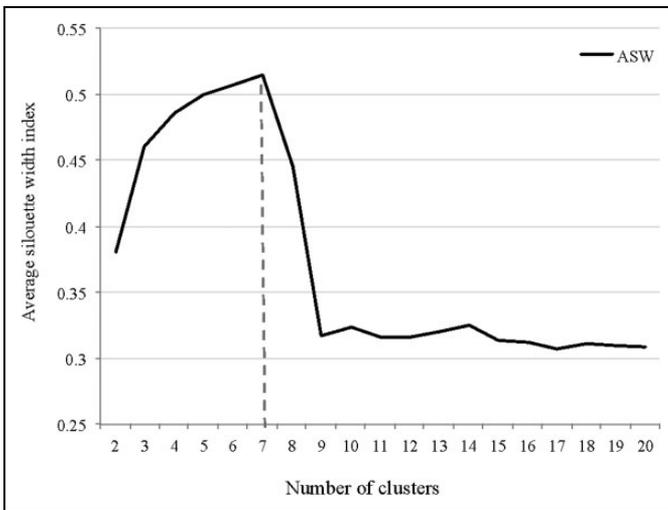
Figure 1. Average Silhouette Width Index.

points, and by statuses followed in a similar order. To identify similar types of trajectories in this study, we used Ward's (1963) hierarchical cluster method. Then, to determine the most appropriate and informative number of types of trajectories, we employed the Average Silhouette Width (ASW) Index, which ranges from zero to one, being an index equal or higher than 0.5 an accepted threshold for being certain about the robustness of results (Kaufman & Rousseeuw, 1990). With these reconstructed types of trajectories, we are able to identify the most representative patterns of labor-force trajectories for the cohort of individuals aged 30–60 between 1980–1985 and 2010–2015.

In sum, this strategy allows us to evaluate working trajectories in light of the microeconomic assumptions that policy makers and scholars have made with regard to IRA's functioning. All the statistical analyses have been performed in R Core Team, (2018), specifically with the TraMineR package for sequence analysis (Gabadinho, Ritschard, Mueller, & Studer, 2011).

Results

Figure 1 shows the results of the ASW Index. It indicates that the diverse labor-force trajectories followed by workers between the ages of 30 and 60 are best summarized in seven typologies.

In Figure 2, we can see these seven types of labor-force trajectories. These seven types are presented in two kinds of plots: first, chronogram plots, which illustrate the overall path followed by all the individuals grouped in each type; second, sequence index plots, which show the path followed by each individual clustered in a specific type (Gabadinho et al., 2011). In the right-hand column of Figure 2, each of the nine mutually exclusive work statuses is depicted by a different color. In this way, it is easier to see the work transitions clustered around the seven resulting work trajectories. At the bottom of this column, there are two additional statuses reflecting missing values in sequences.[1]

The first type is the "conventional work–life cycle," which corresponds to a labor-force trajectory that fits IRA's assumptions regarding pension contributions and formal employment. It is the biggest category (44.0%, $N =$ 1,663) and is composed of wage earners working under formal, full-time, and stable employment conditions, who contribute continuously to their individual pension accounts.

The remaining types, however, are inconsistent with the IRA's assumptions. The second type corresponds to a group that we name "out of the labor force" (31.4%, $N =$ 1,186). This category is the exact opposite of the first trajectory and includes individuals who remain inactive, unemployed, or are looking for a job during the whole period of interest and who consequently did not contribute to the pension system at all. As we will see, this grouping is relevant for women and individuals with more erratic work trajectories who do not make it into administrative records as they have little or no contributions.

The third largest group corresponds to "full-time self-employed not contributing" (11.2%, $N =$ 424), which includes self-employed workers who do not contribute to the pension system at all (as expected, as they were not obliged to) and who have always been self-employed or switched to self-employment after a brief stint as wage earners (generally after age 35). These first three types summarize the labor-force trajectories followed by 86.6% of the individuals in our sample. Therefore, these are the main employment paths experienced by the cohort that began contributing in the 1980s under the IRA scheme, and which is retiring in the 2010s.

The remaining four types represent marginal proportions of the sample and reflect the following labor-force trajectories: (4) "wage earners not contributing" (5.3%, $N =$ 201) comprises wage earners who do not contribute to a pension fund, among which about a third start contributing toward the end of their careers; (5) "full-time self-employed contributing" (3.8%, $N =$ 142) groups together the full-time self-employed who contribute to a pension fund
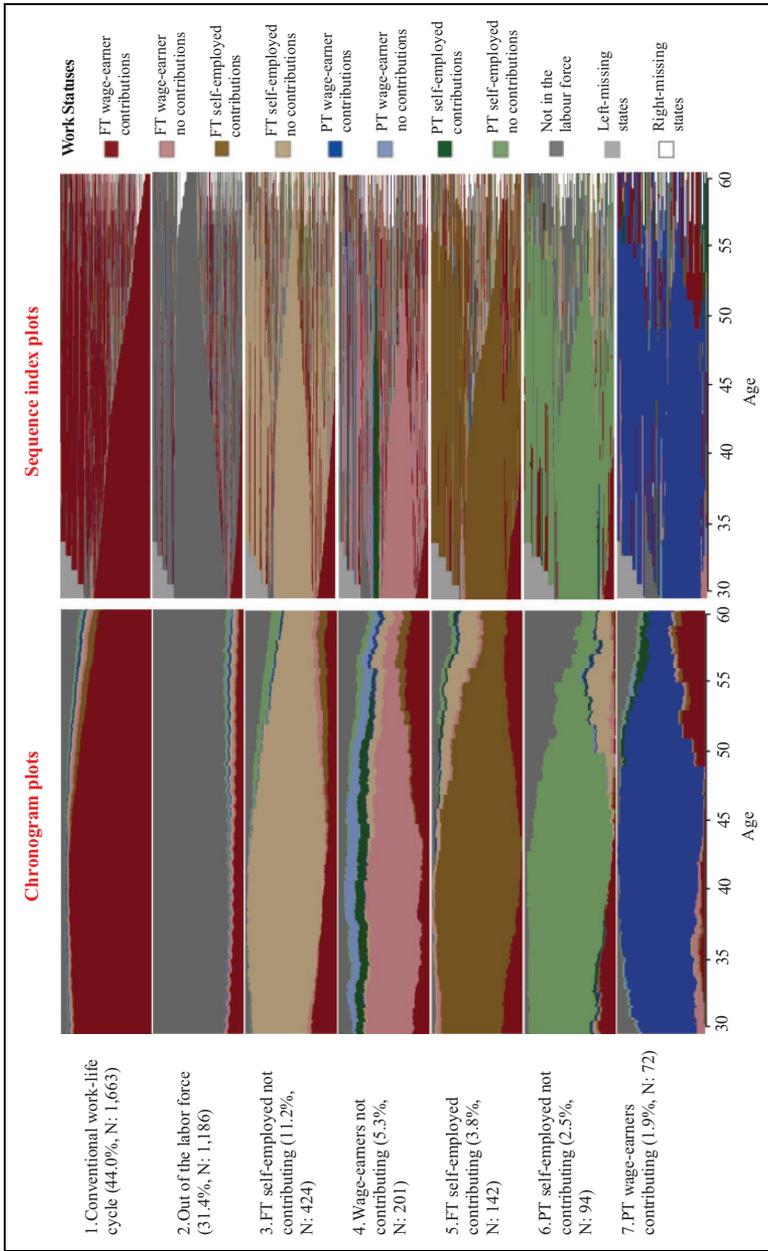
Figure 2. Seven types of labor-force trajectories between ages 30 and 60 in Chile. FT = full-time; PT = part-time.

from the beginning of their careers; (6) "part-time self-employed not contributing" (2.5%, $N = 94$) includes part-time self-employed workers who do not contribute to their pension accounts, among which some move to full-time positions in the late period of their working life; (7) "part-time wage earners contributing" (1.9%, $N = 72$) clusters part-time employees who contribute to pension funds, among which a small group from age 50 onward start to move to full-time jobs.

After examining employment formalization and pension contribution histories, Table 1 breaks down these seven trajectory types by demographic characteristics to evaluate social inequalities. Demographic information is taken at age 60, that is, at the end of the observation period. We assess the association between trajectories and demographic variables using χ^2 and analysis of variance. As shown in the table, women are a substantial majority in those trajectories which are inconsistent with the assumptions of an IRA system, either because they are not participating in the labor market (88.2% of those in out of the labor force trajectory) or because they are participating on a part-time basis (76.4% among part-time wage earners contributing trajectory). The out of the labor force trajectory also boasts one of the highest proportions of people with three or more children (59.3%) and one of the highest rates of people who either have no education or only completed primary education (54.1%). In contrast, men are more likely to follow trajectories characterized by continuous full-time employment either as wage earners or on a self-employed basis (64.6% and 78.1% in the conventional work–life cycle and full-time self-employed not contributing trajectories, respectively). Men are also more likely to contribute to their pension funds on a continuous basis (78.2% among full-time self-employed contributing trajectory). Furthermore, both the conventional work–life cycle and full-time self-employed contributing have the largest proportion of individuals with tertiary education (19.8% and 17.6%, respectively). In terms of pension income, not surprisingly, we observe that trajectories characterized by formal employment and continuous pension contributions (conventional work–life cycle and part-time wage earners contributing) are associated with the highest pension income deciles. However, trajectories that are penalized in pension income (e.g., out of the labor force or full-time self-employed not contributing) are to some extent compensated by the income of other members of the household. Birth year is similar for the seven categories, which confirms we are analyzing a specific cohort. Finally, although the highest percentage of married people (76.8%) and lowest proportion of single individuals (9.2%) concentrate in full-time self-employed contributing, marital statuses are rather equally distributed across our typologies.

Table 1. Descriptive Statistics of Seven Types of Labor-Force Trajectories.

Labor-Force Trajectory Types	1	2	3	4	5	6	7
Female (%)	35.4[a]	88.2[a]	21.9[a]	47.3[a]	21.8[a]	41.5[a]	76.4[a]
Birth year	1953 (4.3)[b]	1953 (4.3)[b]	1953 (4.2)[b]	1953 (4.3)[b]	1952 (4.2)[b]	1952 (4.3)[b]	1952 (3.6)[b]
Education (%)							
None or primary	34.8[a]	54.1[a]	51.7[a]	57.7[a]	35.9[a]	59.6[a]	26.4[a]
Secondary	45.1[a]	40.1[a]	42.0[a]	38.8[a]	45.8[a]	38.3[a]	27.8[a]
Tertiary	19.8[a]	5.3[a]	5.7[a]	3.5[a]	17.6[a]	0.0[a]	45.8[a]
Pension income decile (mean [standard deviation])	6.5b [2.9]	4.1b [2.5]	4.6b [2.4]	4.1b [2.6]	5.8b [2.4]	4.6b [2.6]	6.2b [3.0]
Household income decile (mean [standard deviation])	5.4b [2.9]	5.6b [2.7]	5.2b [2.8]	5.1b [2.6]	4.9b [3.0]	5.4b [2.8]	5.7b [3.0]
Number of children (%)							
0	9.0[a]	7.9[a]	11.1[a]	13.9[a]	6.3[a]	5.3[a]	15.2[a]
1	14.1[a]	8.9[a]	10.8[a]	8.5[a]	12.7[a]	10.6[a]	6.9[a]
2	27.9[a]	23.3[a]	21.9[a]	22.9[a]	36.6[a]	34.0[a]	34.7[a]
3 or more	47.8[a]	59.3[a]	54.2[a]	53.2[a]	43.7[a]	48.9[a]	43.1[a]
Marital status							
Married or partnered	66.8[a]	64.2[a]	65.3[a]	59.2[a]	76.8[a]	71.3[a]	58.3[a]
Divorced or separated	13.2[a]	12.4[a]	12.0[a]	13.4[a]	8.5[a]	8.5[a]	13.9[a]
Widow	5.6[a]	12.3[a]	8.3[a]	9.0[a]	5.6[a]	6.4[a]	8.3[a]
Single	14.0[a]	11.0[a]	14.2[a]	18.4[a]	9.2[a]	13.8[a]	19.4[a]
Number of individuals	1,665	1,186	424	201	142	94	72
Percentage of individuals	44.0	31.4	11.2	5.3	3.8	2.5	1.9

Note: FT = full time; PT = part time. Information of demographic variables was obtained at age 60. Nonnumeric variables reported in percentages. Numeric variables reported in means. Standard errors in brackets. Names of trajectory types: 1 = conventional work–life cycle, 2 = out of the labor force, 3 = FT self-employed not contributing, 4 = wage earners not contributing, 5 = FT self-employed contributing, 6 = PT self-employed not contributing, 7 = PT wage earners contributing. In grey, labor-force trajectory types with sufficiently large observations are highlighted.

[a] Association between trajectory types and descriptive variables assessed using χ^2 analysis ($p < .05$).

[b] Association between trajectory types and descriptive variables assessed using analysis of variance ($p < .05$).

In summary, trajectories showing a weak attachment to the labor market and almost null pension contributions cast a critical shadow over IRA's microeconomic assumptions and long-term prospects in Chile. Pension returns and household income seem similar across work trajectories likely thanks to policies aiming to compensate for low pensions and poverty in old age. Most inequalities in labor-force trajectories seem to relate to access to precarious jobs and informal markets among the less educated and women. For the main cohort of formal workers, however, the assumptions of the system seem to hold.

Conclusions

In this study, we evaluated three hypotheses on generally neglected microeconomic dimensions in research about the Chile's paradigmatic private pension regime. Specifically, using a panel dataset and longitudinal methods, we reconstruct the labor-force trajectories of a cohort of individuals who began working at the outset of this private pension regime in the early 1980s and has retired in the 2010s (therefore were covered almost exclusively by the IRA scheme) and then examined intracohort dynamics of pension contribution histories, formal employment pathways, and unequal access to contributions and formality.

The labor-force trajectories of this cohort proved to be heterogeneous. Crucially, over half the working population developed a labor trajectory inconsistent with the first two assumptions that proponents of the system made, characterized by low pension contributions, informal work, or exclusion from the labor market. However, these trajectories affect less educated workers and women more negatively among the studied cohort, thus exacerbating social inequality in the long run.

Therefore, our initial hypotheses concerning policy makers' microeconomic assumptions do not necessarily hold. Our findings do not suggest that IRA's development has been associated with substantial gains in pension contributions or employment formalization for this first cohort. However, there are some indications that certain social groups are particularly less likely to contribute to pensions and to work in formal positions system under the IRA scheme, and who develop then a high risk of poverty in later life as a consequence of their weak and precarious labor-force trajectories (Shuey & O'Rand, 2006). Nevertheless, these are possibly the same social groups who were at a disadvantage in Chile's old PAYG system (Mesa-Lago, 1985).

These results add crucial information to existing debates about the performance and sustainability of IRA-based pension regimes. First, in view of the potential risk faced by these workers in old age, an important consideration for the future of pension systems concerns the achievement of the objectives of the pension system: coverage, sufficiency, and sustainability. Our findings would support the recommendations made by several experts that, in order to improve financial well-being in old age, IRA schemes must be complemented by noncontributory pillars of defined-benefit or alternative pension savings (subsidies, bonuses, etc.; Melguizo et al., 2015). However, such a noncontributory pillar should not disincentivize individual savings given the known challenges associated with an aging population (see discussion in CAPSP, 2015).

More interestingly, these results suggest that both policy and decision makers focused on aging topics should be aware of the diversity of labor-force trajectories when reforming pension systems. Traditionally, PAYG systems assumed a formal, full-time, male breadwinner. IRA schemes also assume a typical worker, able to save toward an individual account in light of the formal, full-time, and stable nature of its work. In other words, both private and public pension systems have microeconomic assumptions underlying macroeconomic objectives: They assume individual-level choices with regard to savings and employment that need to be constant throughout the life course in order to fit the requirements of a social or aggregate-level pension policy. However, reality proves to be more complex. The analyses of this study regarding pension contribution histories, formalization of employment, and social gaps in both contribution and formalization, show a significant degree of heterogeneity that limits the coverage of IRA pension systems as well as the replacement rates they are able to support.

Furthermore, in light of current research on labor markets, labor-force trajectories might become even more heterogeneous in the future (Kalleberg, 2009). The gradual increases in nonstandard forms of employment in the past few decades, including robotization and digitization, have been driven by a variety of factors, including demographic shifts, labor market regulation, macroeconomic fluctuations, and technological changes (Maurizio, 2016). These unconventional forms of employment should create unique challenges; first, for IRA and PAYG schemes, as these new working arrangements constrain the ability of individual workers to contribute on a continuous basis to their pensions, and second, for the fiscal capacity of states to provide increasing noncontributory benefits.
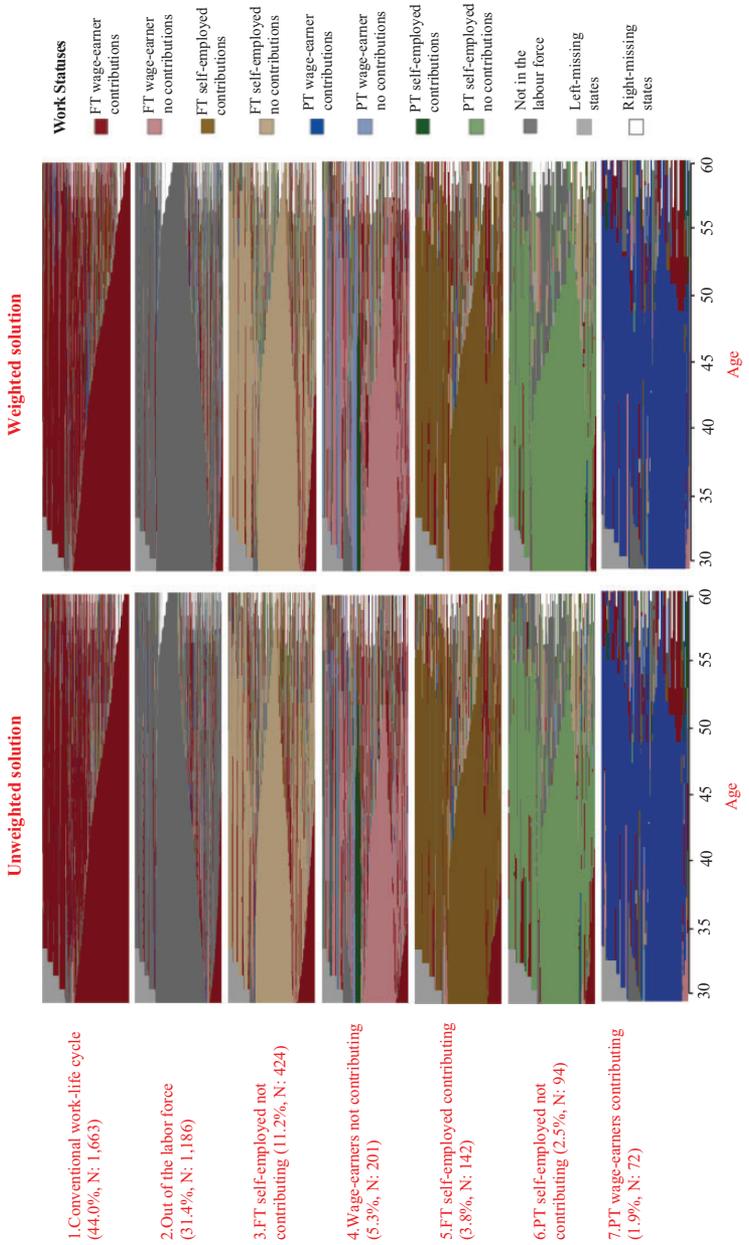
Finally, our findings emphasize the importance of a longitudinal and life-course perspective for the assessment of aging policies (Hungerford, 2007; Komp-Leukkunen & Johansson, 2015). The sustainability of pension systems is a function of individual choices, decisions, and institutional constrains over the life course. Cross-sectional data give us aggregate information of current retirees of different ages but remain silent about the intracohort processes that determine these aggregate numbers (Komp-Leukkunen, 2019). We believe that with a life-course perspective, longitudinal data, and longitudinal statistical tools, we can refine policies to intervene precisely in those periods in life when one is confronted with decisions that are fundamental for the future well-being in old age. For instance, our analyses show that labor-force trajectories seem to be fairly stable. Once you start in one, change is not common. Therefore, ages 30–35 seem to involve a critical life period to strengthening workers to be integrated and remain in formal employment and contributing to their individual pension account (see OECD, 2017b for further discussion).

While we are confident of the labor-force trajectories of the cohort analyzed in this study, results could be different for subsequent cohorts who began working and contributing in the late 1990s and 2000s. These cohorts would be sensitive to recent pension reforms (including the obligation for the self-employed to contribute) and possibly more likely to fit the assumptions of the IRA system. In addition, we should be aware of the limitations of this study. As discussed above, the use of life history calendars to reconstruct life trajectories does not fully eliminate potential recall bias and misreporting. Sequence analysis allows us to arrange life events chronologically and therefore increase our confidence in these results; however, other longitudinal tools might yield slightly different results as a function of alternative models' assumptions.

The results of this research open new directions for future research. We have uncovered patterns of working lives without exploring the reasons why individuals choose or are constrained by them. The reasons why people do not contribute to individual pension accounts might be multiple. For instance, it is only recently that Chile introduced mandatory contributions for the self-employed. This obligation did not exist for the cohort we studied. In addition, law enforcement might be low. The creation of an IRA scheme under a military dictatorship could also make some people more reticent to contribute as they consider the system illegitimate or benefiting AFPs profits (Engel et al., 2017). These and other questions will be addressed in prospective studies.

Appendix A

Table A1. Unweighted and Weighted Solutions of Seven Types of Labor-Force Trajectories Between Ages 30 and 60 in Chile.

Work Statuses

- ■ FT wage-earner contributions
- ■ FT wage-earner no contributions
- ■ FT self-employed contributions
- ■ FT self-employed no contributions
- ■ PT wage-earner contributions
- ■ PT wage-earner no contributions
- ■ PT self-employed contributions
- ■ PT self-employed no contributions
- ■ Not in the labour force
- ■ Left-missing states
- □ Right-missing states

Unweighted solution   **Weighted solution**

1. Conventional work-life cycle (44.0%, N: 1,663)
2. Out of the labor force (31.4%, N: 1,186)
3. FT self-employed not contributing (11.2%, N: 424)
4. Wage-earners not contributing (5.3%, N: 201)
5. FT self-employed contributing (3.8%, N: 142)
6. PT self-employed not contributing (2.5%, N: 94)
7. PT wage-earners contributing (1.9%, N: 72)

Note: FT = full-time; PT = part-time.

Declaration of Conflicting Interests

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Note

1. The TraMineR package in R makes the distinction between left-missing states and right-missing states for missing values placed in the first and second half of trajectories, respectively.

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